



**Energy Efficiency and Renewable Energy  
Federal Energy Management Program**

## Federal Supply Sources:

- Defense Logistics Agency (DLA)  
Phone: (800) DLA-BULB  
[dscp103.dscpl.dla.mil/gi/general/light1.htm](http://dscp103.dscpl.dla.mil/gi/general/light1.htm)
- General Services Administration (GSA)  
Phone: (817) 978-8640  
[www.fss.gsa.gov](http://www.fss.gsa.gov)

## For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.  
Phone: (800) 363-3732  
[www.eren.doe.gov/femp/procurement](http://www.eren.doe.gov/femp/procurement)
- FEMP's *Federal Lighting Guide* and other resources provide helpful guidance on lighting projects.  
Phone: (800) 363-3732  
[www.eren.doe.gov/femp/resources/lighting.html](http://www.eren.doe.gov/femp/resources/lighting.html)
- National Electrical Manufacturers Association (NEMA) publishes Standards Publication LE-5B, *Procedure for Determining Luminaire Efficacy Ratings for High Intensity Discharge Industrial Luminaires*, as well as other information on industrial lighting.  
Phone: (800) 854-7179  
[www.nema.org](http://www.nema.org)
- Green Seal's July, 2000 "Choose Green Report" provides valuable information on selecting HID luminaires.  
Phone: (202) 872-6400  
[www.greenseal.org](http://www.greenseal.org)
- Illuminating Engineering Society of North America (IESNA) publishes guidelines and other information on industrial lighting.  
Phone: (212) 248-5000  
[www.iesna.org](http://www.iesna.org)
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.  
Phone: (202) 646-7950

# How to Buy Energy-Efficient Industrial HID Luminaires

## Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR<sup>®</sup> product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.

## Efficiency Recommendations

Upward Efficiency <sup>a</sup>	Lamp Wattage	Closed Fixture (HC) LER <sup>b</sup>		Open Fixture (HO) LER <sup>b</sup>	
		Recommended	Best Available	Recommended	Best Available
Metal Halide Lamps					
0%	150 - 399	41 or higher	64	(insuff. data)	63
	400 - 999	53 or higher	67	59 or higher	69
	≥ 1000	77 or higher	83	(insuff. data)	110
1% - 10%	150 - 399	56 or higher	70	(insuff. data)	53
	400 - 999	62 or higher	67	64 or higher	70
	≥ 1000	(insuff. data)	99	88 or higher	108
11% - 20%	150 - 399	57 or higher	69	(insuff. data)	67
	400 - 999	65 or higher	73	69 or higher	75
	≥ 1000	(insuff. data)	87	(insuff. data)	118
> 20%	150 - 399	62 or higher	73	77 or higher	90
	400 - 999	65 or higher	74	(insuff. data)	75
	≥ 1000	(insuff. data)	96	(insuff. data)	96
High Pressure Sodium Lamps					
0%	150 - 399	58 or higher	76	68 or higher	76
	400 - 999	63 or higher	87	84 or higher	96
	≥ 1000	(insuff. data)	94	(insuff. data)	95
1% - 10%	150 - 399	64 or higher	78	63 or higher	84
	400 - 999	82 or higher	101	89 or higher	111
	≥ 1000	(insuff. data)	92	109 or higher	121
11% - 20%	150 - 399	(insuff. data)	89	78 or higher	87
	400 - 999	(insuff. data)	91	94 or higher	100
	≥ 1000	(insuff. data)	79	(insuff. data)	122
> 20%	150 - 399	75 or higher	80	77 or higher	90
	400 - 999	(insuff. data)	102	(insuff. data)	103
	≥ 1000	(insuff. data)	116	(insuff. data)	121

a) Upward efficiency is the portion of light directed up. Both high-bay and low-bay luminaires are available with opaque reflectors, which direct all or most of the light downward, and with transparent refractors, which direct some light up.

b) LER, or luminaire efficacy rating, describes the efficiency of a luminaire in terms of rated light output (in lumens) per watt of electricity use. A lumen is a standard measure of light output.

The federal supply sources for HID (high intensity discharge) luminaires are the Defense Logistics Agency (DLA) and the General Services Administration (GSA). DLA sells HID luminaires through its *Energy Efficient Lighting* catalog, available on its Web site. GSA offers them on Schedule 62-II, as well as through its on-line shopping network, *GSA Advantage!* Select or specify models that meet the recommended LER for that luminaire type.

Buyers should select or specify luminaires with Luminaire Efficacy Ratings (LERs) that meet the recommended levels, based on industry standard tests. However, the LER rating may not be available for some manufacturers' products. If an LER rating is not available, it can be estimated from other photometric data using this formula:

$$\text{LER} = \left( \frac{\text{Total Rated Lamp Lumens} \times \text{Ballast Factor} \times \text{Luminaire Efficiency}}{\text{Input Watts}} \right)$$

Rated lamp lumens, ballast factor, and luminaire efficiency (see "Definitions," right) may be found in manufacturers' photometric reports and in some catalogs. Many industrial HID luminaires provide multiple socket positions to accommodate different lamps and provide narrow or wide light distribution. Narrower light distribution tends to lower LER.

Two types of HID lamps are typically used in industrial applications: metal halide (MH) lamps and high-pressure sodium (HPS) lamps. HPS lamps generally have higher efficiency and longer life, but usually do not provide as good color rendition as MH lamps. HPS lamps are more commonly used at higher wattages. Mercury vapor and low-pressure sodium (LPS) lamps are not commonly used in industrial applications because of their poor color rendition. Mercury vapor lamps are much less efficient than other HID's.

"Pulse-start" metal halide lamps and compatible energy-efficient ballasts provide both reduced input watts (25% savings) and increased light output compared to standard MH lamps, approaching the efficiency of HPS lamps. Pulse-start lamps also provide much faster re-strike times, improved color rendering and color stability, and longer lifetimes.

Capacitive switching with special HID ballasts can provide bi-level lighting control for use with occupancy sensors in warehouses, garages, or other areas with intermittent occupancy. Because of the delay in re-strike time, it is generally not practical to shut off HID lights completely except during extended periods of non-occupancy.

## Where to Find Energy-Efficient Industrial HID Luminaires

### Definitions

*Ballast Factor (BF)* is the ratio of the light output of lamp(s) operated by a ballast to the light output of the same lamp(s) operated at rated current and voltage.

*Luminaire Efficiency (LE)* is the light output, in lumens, divided by the total rated lamp lumens.

## Buyer Tips

## Technology Options

### Definitions

"Pulse-start" metal halide lamps use a special ignition system that allows a faster "re-strike" (light-up) time.

### Industrial HID Luminaire Cost-Effectiveness Example (Closed Fixture HPS Lamp, 150-400 watts, 1-10% Upward Effic.)

Performance	Base Model	Recommended Level	Best Available
Luminaire Efficacy Rating (LER)	40	64	78
Luminaire Light Output	11,800 lumens	15,700 lumens	13,300 lumens
Power Input	295 watts	245 watts	170 watts
Annual Energy Use	1060 kWh	880 kWh	610 kWh
Annual Energy Cost	\$64	\$53	\$37
Lifetime Energy Cost	\$670	\$560	\$390
Lifetime Energy Cost Savings	-	\$110	\$280

Annual Energy Use is based on 3,600 operating hours per year.

Lifetime Energy Cost is the sum of the discounted value of annual energy costs based on average usage and an assumed luminaire life of 15 years. The assumed electricity price is 6¢ per kWh. Future electricity price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001).

### Using the Cost-Effectiveness Table

In the example above, the luminaire at the Recommended Level, with an LER of 64, is cost-effective if its price does not exceed the price of the Base Model by more than \$110. The Best Available luminaire, with a 78 LER, is cost-effective if its price does not exceed the price of the Base Model by more than \$280.

